Whakatane liquefaction case history from the 1987 Edgecumbe Earthquake

Examination of an extensive CPT dataset supplemented by paleo-liquefaction investigations

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Background

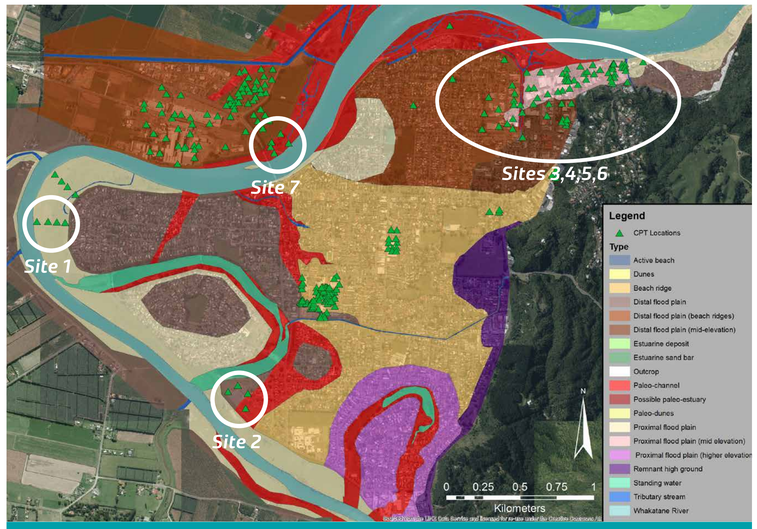
Liquefaction and associated lateral spreading during the 1987 M_L 6.3 Edgecumbe earthquake caused severe damage within parts of the Whakatane township in the North Island of New Zealand. Liquefaction and lateral spreading was well documented proximal to the waterways in areas underlain by recent fluvial and marine sediments. Recent studies utilizing an extensive set of CPT investigations indicate that much of the Whakatane CBD is underlain by sediments with a low cyclic resistance to liquefaction. No evidence of liquefaction was observed within the CBD following the Edgecumbe earthquake, despite the severe liquefaction manifestation and lateral spreading predicted under the likely ground motions of the Edgecumbe earthquake.

Methodology

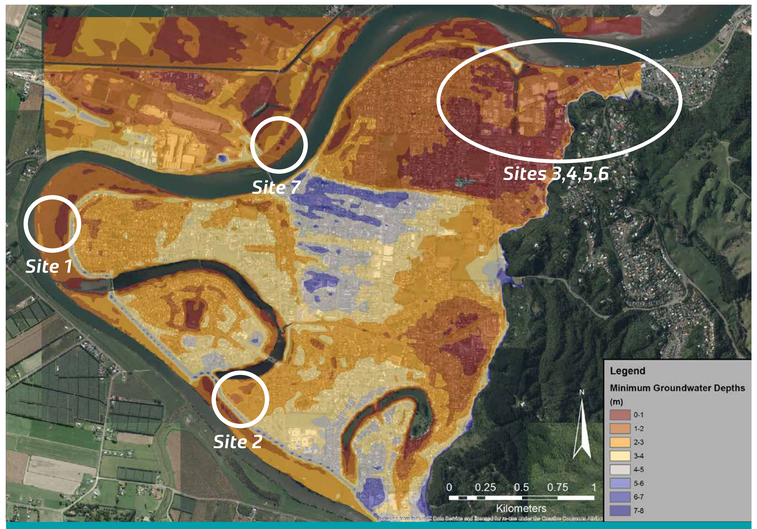
Paleo-liquefaction trenching investigations undertaken at selected sites within the CBD enabled characterization of the subsurface sediments including the critical layers identified within the liquefaction analysis, and to determine whether any evidence of subsurface liquefaction was evident at the sites. Paleo-liquefaction investigations were additionally undertaken at sites known to have liquefied during the Edgecumbe earthquake to determine whether subsurface evidence of pre-historic liquefaction (i.e. pre 1987) can be identified. The aim of the investigations is to identify whether

Methodology *(continued)*

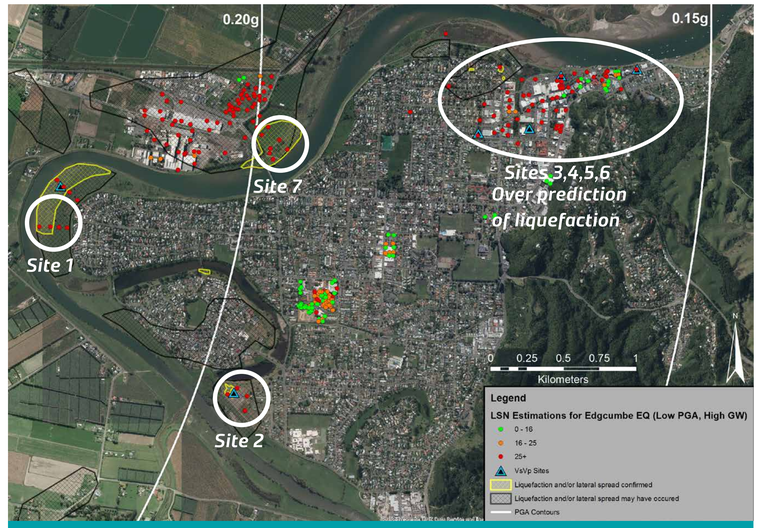
multiple episodes of liquefaction-triggering earthquakes have occurred within the region, and whether there is evidence for liquefaction within the soils in the Whakatane CBD. Detailed evaluation of the existing CPT dataset will be undertaken for each site and supplemented with direct push crosshole shear wave velocity testing to examine whether the predicted liquefaction triggering is consistent with the constraints developed from the paleo liquefaction trenching work. Where the liquefaction triggering is shown to be inconsistent, the potential reasons for over prediction will be examined.



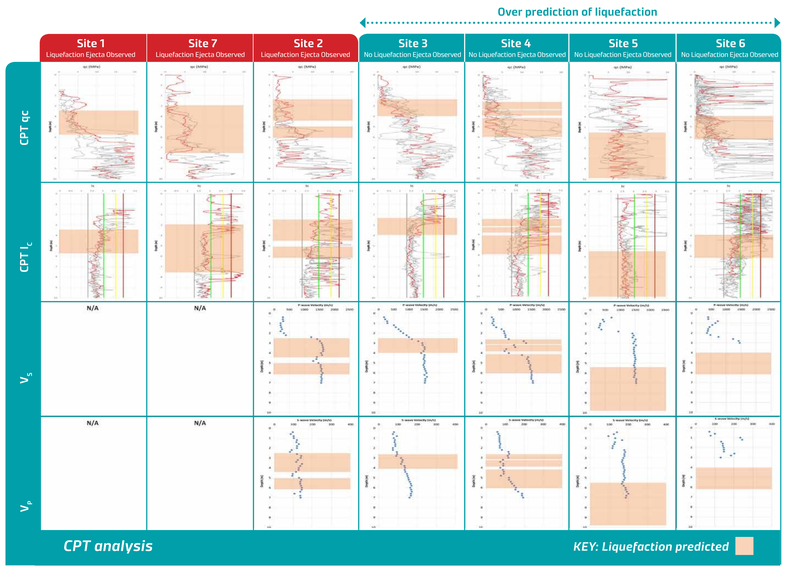
Geomorphic map



Groundwater model

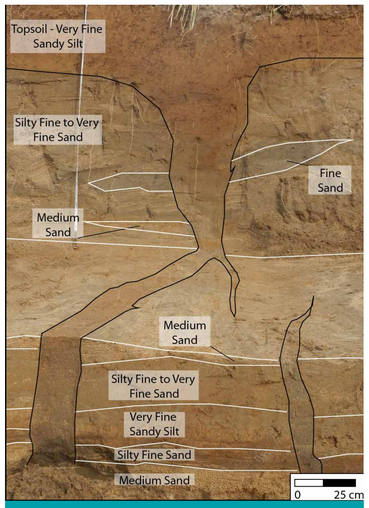


PGA map and calculated liquefaction vulnerability

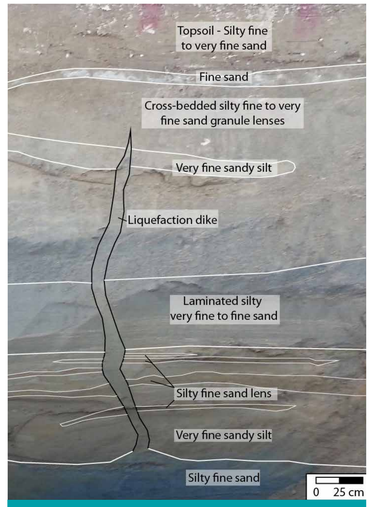


CPT analysis

KEY: Liquefaction predicted



Site 1: Trench Investigations - South Wall W ►



Site 2: Trench Investigations - South Wall W ►

Anticipated outcomes

It is anticipated that the results of this work can be added to the international liquefaction case history database, improve the understanding of the liquefaction performance of silty soils, will help to characterize the liquefaction hazard of the Whakatane region, assist in the assessment of earthquake prone buildings within the CBD, and inform future land-use development decisions.

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